

NEW VARIETIES OF APPLES WITH GENETIC DISEASE RESISTANCE, OBTAINED AT VOINEȘTI DEVELOPMENT RESEARCH STATION FOR FRUIT GROWING

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Abstract

The research carried out at Voinesti research-development station for fruit growing, considered highlighting the performance characteristics of some apple varieties with genetic resistance to diseases, approved in the period 2004 - 2020.

The vigour of growth in the 10th year of the trees, grafted on the M.9 rootstock, is well defined by the trunk circumference, which records values between 14.9cm for the Cezar variety and 18.4cm for the Redix variety. The volume of the crown calculated per surface unit, at the plot of 2,857 trees/ha, was 6,520 mc/ha for the Brumar variety, being of low-medium vigour, and 8,800 mc/ha for the Redix varieties, being more vigorous.

The productivity during the full fruiting period of the 10 apple varieties with genetic resistance to diseases, cultivated in a high density system, was between 28 - 45t/ha, the most productive being the Iris, Real, Remar, Valery, Brumar and Cezar varieties with productions of over 35 t/ha.

The biomass of the fruits was between 155 and 180g, smaller fruits being recorded in the varieties Iris, Inedit, Voinicel and Revidar and larger in the varieties Cezar, Valery, Remar and Redix with fruits over 170g that correspond to market requirements.

The apple varieties approved at SCDP Voinesti between 2004 and 2020 meet the demands of the producer, sensitive to economic efficiency, with high production potential, with quality fruits, which will certainly meet the ever-growing consumer demands.

Key words: *new apple varieties resistant to diseases, vigour, productivity, fruit quality.*

INTRODUCTION

The apple assortment has seen a significant change in recent decades, with varieties being promoted that mainly target the demands of the producer, sensitive to economic efficiency, high production potential, the aspect of the fruit, different periods of consumption, etc., as well as the taste of the consumer. These requirements are satisfied by expanding the cultivation of apple varieties with genetic resistance to diseases, which for the new plantations are the links of high-performance economic technology, with immediate effect through the total or partial elimination of fungicide treatments.

In the promotion of apple varieties with genetic resistance to diseases, an important role was played by Voinesti research and development station for fruit-growing, either through its own creations or the study of foreign varieties, succeeding to a large extent to change the concept of growers and the gradual change of assortment.

The improvement process being continuous, it allowed over time the creation and approval of a number of 22 apple varieties with genetic resistance to diseases, valuable varieties that will certainly meet the ever-growing consumer demands.

MATERIALS AND METHODS

The complex genetic base existing at Voinești research and development station for fruit-growing, composed of selection fields, the hybrid nursery and competition micro cultures, was the main source for the creation of apple varieties with genetic resistance to diseases, most of them being propagated in SCDP Voinești nursery and given back to the apple growers.

The apple varieties with genetic resistance to diseases, created at SCDP Voinești, correspond from the point of view of productivity and fruit quality, they were analysed according to the criteria and techniques necessary for the approval established by the DSO and VAT tests, becoming varieties.

In order to highlight the performance characteristics, to some of the approved apple varieties, the culture technology was correctly applied so as not to affect the production capacity and the quality of the fruits.

The research undertaken highlights the growth and fruiting potential of the new apple varieties with genetic resistance to diseases, where the trees were planted at a distance of 3.5x1 m (2,857 trees/ha), being grafted onto the M9 rootstock, with the shape of spindle crown.

During the years of study, observations and determinations were made regarding the increase in trunk thickness, tree crown dimensions, production recording and fruit quality, through their biomass and dry matter content

RESULTS AND DISCUSSIONS

Obtaining apple varieties is a long-term and highly complex activity, especially when considering obtaining varieties with genetic resistance to diseases, regardless of the research method used.

A newly created variety, in addition to the characteristics of productivity, superior fruit quality, genetic resistance to diseases, depending on the cultivation area, must meet other characteristics that are added to the essential conditions, namely:

- degree of adaptability to climatic conditions;
- the destination of the production, depending on the degree of knowledge of the variety;
- the market requirements of the obtained production;
- the safety of the source of production and delivery of tree planting material;
- the economy of culture technology.

During the 10 years of vegetation, the apple varieties approved at SCDP Voinești, vegetated properly, began to bear fruit as early as the 3rd year after planting, ensuring quantitatively and qualitatively superior productions, resistance to rot and partial to powdery mildew.

The vigour of the trees in a quantitative aspect is given by the volume of vegetative growth accumulated annually, expressed by the dimensions of the trunk, the height and the dimensions of the crown of the trees, these being determined by the vigour of the variety, the unchanged factor being the rootstock.

The vigour of growth in the 10th year of the trees, when the growth potential is well defined, shows us that between the apple varieties with genetic resistance to diseases approved in the period 2004 - 2020, there are significant differences in terms of growth in thickness of the trunk, height and crown dimensions (*Table 1*).

In the 10th year after planting, the trunk circumference of the 10 apple varieties approved at SCDP Voinești, grafted on the M9 rootstock, recorded values between 14.9 cm for the Cezar variety and 18.4 cm for the Redix variety, the other varieties show intermediate values between 15 and 17.9 cm.

The volume of the crown ensures the supporting structure of the branches, leaves and fruits and has values depending on the size of the trees. The height of the trees in the 10th year records values between 220 and 280 cm, with the thickness of the fruit fence of 120 - 140 cm. The volume of the crown calculated per surface unit at the planting plot of 2,857 trees/ha was 6,520 mc/ha for the Brumar variety and 8,800 mc/ha for the Redix

variety, values corresponding to the age of the trees. Based on the vigour values, the 10 varieties approved at SCDP Voinești, most of them belong to medium vigour varieties (Redix, Remar, Valery) and low-medium vigour varieties (Cezar, Revidar, Brumar, Iris, Inedit).

In order to evaluate the rhythm of fruiting phenophases, the data related to: the beginning and end of flowering, its duration, but also the ripening period of the fruits were recorded.

From the recorded data, it can be seen that the first flowers opened on the varieties Iris, Inedit and Voinicel, starting from April 15 - 18, followed by the other varieties between 20 - 22.04. The last one, the Valery variety, opened its flowers on 24.04. The end of flowering took place between 24.04 and 6.05, so that the 10 varieties of apple belong to varieties with a middle flowering period and a duration of flowering between 7 and 12 days, depending on the evolution of climatic conditions.

The new apple varieties approved at SCDP Voinești, totally or partially overlapped during flowering, allowing their mutual pollination.

Fruit ripening took place between 25 and 31.08 for the Revidar and Real varieties, being considered as summer varieties, 01 - 10.09 for the Remar and Brumar varieties as summer-autumn varieties, 10 - 20.09 for the Iris, Voinicel and Cezar varieties as autumn varieties and 25.09 – 01.10 for the

Valery, Inedit, Redix varieties, which present winter fruits, but with a longer storage of the fruits for the Valery variety.

The duration of fruit storage was 25-35 days for summer varieties, 40-50 days for summer-autumn varieties, 70-86 days for autumn varieties and 125-150 days for winter varieties, under storage conditions of apples in storage with natural cooling.

One of the priority objectives of the undertaken study is the appreciation of the production capacity, being the most important characteristic in the promotion of varieties for the establishment of new commercial plantations. The high productive potential, associated with a superior fruit quality, expresses to the highest degree the ability of apple varieties with genetic resistance to diseases, to assimilate and capitalize on the ecological conditions of the area where they are grown.

The productivity of apple varieties is a complex characteristic, genetically determined by the hereditary base from which it comes, but it is influenced by the interaction between the variety and the climatic conditions of the cultivation area. Other factors that contribute to shaping this characteristic are related to the precocity of fruiting, the type of fruiting, the applied technology, disease resistance, grafting and pollination compatibility, planting density and the rootstock used.

Table 1. The particularities of growth and fruiting of the new apple varieties with genetic resistance to diseases, approved at SCDP Voinești

Characteristics	Type and year of approval									
	Redix 2004	Iris 2005	Real 2007	Remar 2008	Inedit 2009	Voinicel 2009	Valery 2016	Cezar 2016	Revidar 2016	Brumar 2020
I. The vigour of tree growth										
Trunk circumference in the 10th year after planting	18,4	15,2	17,2	17,9	16,2	15,2	16,5	14,9	15,0	15,0
The height of the trees - cm	270	220	250	260	240	240	280	260	260	240
The thickness of the fruit fence- cm	140	140	130	140	130	130	130	130	130	120
Crown volume (mc/ha)	8.800	6.800	7.430	8.400	7.060	7.060	8.550	7.800	7.800	6.520
II. Peculiarities of fruiting										
<i>Phenophases of fruiting</i>										
The beginning of	20 -	15 -	20-	20 -	18 -	16 -	24 -	22 -	22 -	20 -

flowering	26.04	20.04	24.04	26.04	22.04	20.04	29.04	28.04	28.04	26.04
The end of flowering	28.04 - 03.05	26 - 30.04	28.04 - 04.05	28.04 - 03.05	28.04 - 02.05	24 - 30.04	01 - 06.05	30.04 - 05.05	30.04 - 05.05	28.04 - 03.05
Flowering time (days)	9-10.	9 - 12	9 - 10	10 - 11	9 - 12	11 - 12	7 - 9	7 - 9	7 - 9	7 - 9
Fruit ripening date	26 - 30.09	15 - 20.09	26 - 31.08	01 - 10.09	25.09 - 01.10	10 - 15.09	25.09 - 01.10	15 - 20.09	25 - 31.08	15 - 20.09
The age of consumption	Oct. - Jan	Sept - Nov.	Sept.	Sept. - Oct.	Oct. - Febr.	Sept. - Nov.	Oct. - March	Oct. - Dec.	Sept.	Sept. - Nov.
Fruit storage time (days)	125 - 130	70 - 75	25 - 30	40 - 50	145 - 150	70 - 75	145 - 150	80 - 86	30 - 35	45 - 50
Production (t/ha)	30-35	40 - 45	35 - 40	38 - 42	30 - 35	28 - 30	35 - 40	35 - 40	28 - 30	35 - 40
<i>The quality of production</i>										
Fruit biomass (g)	170	155	180	170	155	155	185	190	160	165
Content in SU (%)	14,5	14,2	13,5	13,8	15,0	14,5	16,5	13,8	13,0	13,5

The production potential during the full fruiting period of the 10 apple varieties with genetic resistance to diseases, cultivated in a high-density system, was 28 - 45t/ha, the most productive being the apple varieties Iris, Real, Brumar, Remar, Valery and Cezar, with productions of over 35 t/ha.

The quality of the fruits expressed by their biomass was between 155 and 180g, with smaller fruits being recorded for the varieties Iris, Inedit, Voinicel, Revidar and larger for the varieties Cezar, Valery, Remar and Redix, with fruits over 170g. The dry substance content had values between 13 and 16.5%.

The apple varieties with genetic resistance to diseases, approved at SCDP Voinesti between 2004 and 2020, also present other valuable characteristics, which are presented below.



Figure 1. Redix sin. H 3/73-83 Variety

Redix sin. H 3/73-83 Variety Voinesti (Fig. 1), presents oblong truncated fruits, similar to the Starkrimson variety, with red-violet colour skin, a colour that becomes perfect during storage. The pulp becomes yellowishwhite during storage, juicy, sweet-tart, good taste. It is resistant to the attack of *Venturia inaequalis* and *Podosphaera leucotricha*. It stands out for the commercial and attractive appearance of the fruits, good taste.

Iris sin. H 8/94-82 Variety Voinesti (Fig. 2), with the spherical shape of the fruit, slightly flattened with the greenish-yellow

skin covered on 2/3 of the surface with red-carmine.



Figure 2. Iris sin. H 8/94-82 Variety

White – yellowish pulp, juicy, sweet and tart, with good taste. It is resistant to the attack by *Venturia inaequalis* and weakly attacked by *Podosphaera leucotricha*. It stands out for its precocity, the commercial and attractive appearance of the fruits, the fine taste. It differentiates fruit buds every year, regardless of the amount of fruit produced the previous year.

Real sin. H 9/78-82 Variety Voinesti (Fig. 3), with the truncated fruit, red on 2/3 of the surface. The pulp is yellowish-white, juicy, sweet and tart, good taste. It is resistant to the attack by *Venturia inaequalis* and weakly attacked by *Podosphaera leucotricha*. It stands out for its precocity, the commercial and attractive appearance of the fruits, the fine taste, it produces constantly and economically.



Figure 3. Real sin. H 9/78-82 Variety

Remar sin. H 1/26-90 Variety Voinesti (Fig. 4), with the shape of the Starkrimson type fruit, truncated, yellow-green background colour, covered on 2/3 of the surface with dark red, white flesh, juicy, good taste. The variety is genetically immune to *Venturia inaequalis* and weakly attacked by powdery mildew (*Podosphaera leucotricha*). It stands out for its precocity, the commercial and attractive appearance of the fruits, the fine taste.



Figure 4. Remar sin. H 1/26-90 Variety

Inedit sin. H 3/5-90 Variety Voinesti (Fig. 5), presents the shape of the conical-globular fruit, the background colour is green-yellow, covered on 2/3 of the surface with bright red (attractive), the flesh is white-yellowish, juicy, good taste. The variety is genetically immune to *Venturia inaequalis* and very weakly attacked by powdery mildew (*Podosphaera leucotricha*). It stands out for early fruiting, fruit quality, ability to keep over the winter.



Figure 5. Inedit sin. H 3/5-90 Variety

Voinicel sin. H 2/5-90 Variety Voinesti (Fig. 6), it presents spherical to flattened spherical fruits, beautifully coloured in red on 3/4 of the surface, and the taste is good. It is resistant to (*Venturia inaequalis*) and exhibits increased resistance to powdery mildew (*Podosphaera leucotricha*). It stands out for its precocity, the commercial and attractive appearance of the fruits, the good taste.



Figure 6. Voinicel sin. H 2/5-90 Variety

Valery sin. H 4/37- 04 Variety Voinesti (Fig. 7), presents the shape of the conical-truncated fruit, yelloworange on the sunny side, with yellowish-white pulp, crunchy when harvested, with a sweet, very good taste. It is resistant to attack by *Venturia inaequalis* and weakly attacked by *Podosphaera leucotricha*. It stands out for its precocity, excellent fruit quality and constant production.

Cezar sin H 1/78-90 Variety Voinesti (Fig. 8), with the shape of the conical-globular fruit, covered with red on almost the entire surface. White pulp, sweet and slightly acidic, with a very good taste. It is resistant to the attack of *Venturia inaequalis* and *Podosphaera leucotricha*. It stands out for its low-medium vigour, precocity, fruit quality and constant production.



Figure 7. Valery sin. H 4/37- 04 Variety



Figure 8. Cezar sin H 1/78-90 Variety

Revidar sin H 1/16-90 Variety Voinesti (Fig. 9), with conical shaped fruits, covered with red on 2/3 of the surface. The flesh is white, acidic, juicy with a good taste. It is resistant to the attack of *Venturia inaequalis* and *Podosphaera leucotricha*. It stands out for its medium-low vigour, precocity, productivity and constant fruiting.

Brumar sin. H 8/86-92 Variety Voinesti (Fig. 10), was approved in 2020. The tree is of medium vigour, very precocious and productive, bears fruit on short formations, but also on long annual branches. Flowering is medium, overlapping with most apple varieties in culture for cross-

pollination. The average fruit is more than 165 g, it is conical, the background colour is yellow, and the covering colour is red - carmine on 2/3 of the surface. The pulp is yellowish-white, sweet and tart, juicy, with a very good taste. The maturity for harvesting and consumption begins with the first half of September until November. It is resistant to the attack of the *Venturia inaequalis* and weakly attacked by powdery mildew (*Podosphaera leucotricha*).



Figure 9. Revidar sin H 1/16-90 Variety



Figure 10. Brumar sin. H 8/86-92 Variety

The studies and research undertaken at SCDP Voinesti present for apple growers, a group of varieties with different ripening periods that cover a large period of consumption with apples from varieties genetically resistant to diseases.

Currently, the basic assortment includes varieties with genetic resistance to diseases: Romus 1, Romus 3, Romus 4, Prima, Pionier, Voinea, Ciprian, Florina, which are propagated in fruit nurseries in the country.

Some of the mentioned varieties, even if they currently meet the requirements for resistance, productivity and fruit quality, can be replaced as new varieties appear, more valuable, both in terms of production and fruit quality.

The apple varieties with genetic resistance to diseases, created at the Voinesti Resort, can cover a large part of the consumption season, together with some varieties with genetic resistance to diseases existing in the culture, already known and appreciated on the market by consumers.

Table 2 shows the new apple varieties, approved at SCDP Voinesti in the period

2004 - 2020 and how they fit among the apple varieties with genetic resistance to diseases, from the current apple assortment.

Depending on the ripening and consumption period of the fruit, the apple varieties, which stood out for their genetic resistance to diseases, productivity and quality of the fruit, fall differently in the varieties conveyor for Dâmbovită Orchard Pool.

Thus, after the apple varieties Romus 1, Romus 3, Romus 4, the varieties Irisem, Real can be introduced with attractive fruits, ripening in the last decade of August, the first decade of September. After the Prima apple variety comes the Revidar apple variety, which has a consumption period from August 25-31 to October 1.

The Brumar apple variety falls between the Voinea and Pionier varieties, with the perspective that the Voinea variety will be replaced by the Brumar variety, because it presents some superior qualities, both for taste and, especially, for the colour of the fruits.

Table 2. The age of consumption and the inclusion in the varieties assembly line of the resistant apple varieties, grown in the area of influence of the Voinesti Station for Fruit-growing

Variety	MONTH																													
	VII			VIII			IX			X			XI			XII			I			II			III					
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3			
Romus 1 (Vf)		•	•																											
Romus 2 (Vf)		•	•																											
Romus 3 (Vf)				•	•																									
Irisem(Vf)							•	•																						
Real (Vf)							•	•																						
Prima (Vf)							•	•	•																					
Revidar (Vf)							•	•	•	•																				
Remar (Vf)										•	•	•	•	•																
Iris (Vf)										•	•	•	•	•																
Voinea (Vf)										•	•	•	•																	
Brumar (Vf)										•	•	•	•	•	•															

Șapte decenii de activitate și creație științifică în pomicultura românească, 1950 -2020. Bucharest, RO.

Petre, V., Petre, G. (2014). *Genotipuri pomicole tolerante la stres termic, hidric și biotic, pretabile sistemelor tehnologice specifice agriculturii durabile.* Subcap. 4.1. Ameliorarea mărunții și părului la SCDP Voinești. Ghid elaborat în cadrul proiectului sectorial ADER 1.1.9., finanțat de MADR.

Petre, V., Petre, G. (2014). Contributions regarding the apple trees genetic variability increase in the process of obtaining improving biological material.

Scientific papers series B Horticulture. Volume LVIII. USAMV Bucharest.

Petre, V. (2009). *Tehnica obținerii soiurilor de măr cu rezistență genetică la boli prin mutagenză.* Bucharest, RO: Moroșan Publishing House.

Șerboiu, L., Petre, G. (2000). *Stațiunea de cercetare și producție pomicolă Voinești la aniversarea a 50 de ani de cercetare științifică și dezvoltare (1950 - 2000).* Târgoviște, RO: Domino Publishing House.